General Mathematics Paper 2, Nov/Dec 2008

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QUESTION 1

Simplify, without using tables or calculator

1. **31/3 ÷ 11/4 - 4/9;**
2. **2 + √96 - 4 (√6 -1)2 and express your answer in the form m + n√6 where**

m and n are real numbers.

OBSERVATION

The part (a) of the question required the use of BODMAS rule, finding the LCM and simplifying. Most candidates were reported to have followed this procedure and were able to manipulate the fractions well. However, some candidates misinterpreted " ÷" to mean " + ". Others subtracted first before dividing. 31/3 ÷ 11/4 - 4/9 = 10/3 x 4/5 - 4/9 = 8/3 - 4/9 = 20/9 = 22/9

In part (b), many candidates reportedly found the expansion of (√6 -1)2 quite challenging. Others could not reduce √96 to its lowest form. The expansion of (√6 -1)2 = (√6 -1) (√6 -1) = 6 - √6 -√6 + 1 = 7 - 2√6. √96 = √6 x 16 = 4√6
Therefore 2 + √96 - 4(√6 -1)2 = 2 + 4√6 - 4(7-2√6) = 2 + 4√6 - 28 + 8√6 which after a little computation resulted in - 26 + 12√6.

QUESTION 2

(a) Solve the equation $\frac{4x-1}{3} - \frac{3x-1}{2} = \frac{5-2x}{4}$

(b) From a shop, Kofi bought 2 singlets and 3 shirts for GH¢31.00 while Kwasi bought 3 singlets and 2 shirts for GH¢29.00. How much will Yaw pay for one singlet and one shirt he bought from the same shop?

OBSERVATION

According to the chief examiner, part (a) of this question was well attempted by majority of the candidates. They were able to find the LCM of the denominators and cross multiply both sides of the equality sign by the LCM which was 12. Simplifying gave 4(x-1) - 6(3x - 1) -3(5-2x) which further gave x = 31/4. In part (b), it was reported that the question was attempted by majority of the candidates who were able to form the simultaneous equation 2x + 3y = 31; 3x+2y = 29, solve these equation simultaneously to obtain x = 5 and y = 7. However, some of the candidates did not add these values to obtain the required price which was GH¢12.00.

QUESTION 3

The probability that a malaria patient (M) survives when administered with a newly discovered drug is 0.27 and the probability that a thyphoid patient (T) survives when injected with another newly discovered drug is 0.85. What is the probability that

either of the two patients survives?
neither of two patients survive?
at least one of the two patients survive?

Give your answers correct to 2 significant figures.

OBSERVATION

It was reported that the performance of candidates in this question was not commendable. They found it difficult; hence they scored very low marks. They were expected to show that if P(M) = probability of the malaria patient surviving = 0.27, probability of not surviving, P(M¢) = 1- 0.27 = 0.73. Similarly, if P(T) = probability of the thypoid patient surviving = 0.85, then probability of not surviving = P(T1) = 1-P(T) = 1- 0.85 = 0.15. Probability of either surviving = (0.27 x 0.15) + (0.85 x 0.73) = 0.66. Probability of neither surviving =

(0.73 x 0.15) = 0.11. Probability of at least one surviving = 1- 0.11 = 0.89.

QUESTION 4

A sector of angle 135° is removed from a thin circular metal sheet of radius 40cm. It is then folded with the straight edges coinciding to form a right circular cone. Calculate the:

base radius of the cone, correct to two decimal places

greatest volume of liquid which the cone can hold, leaving your answer correct to the nearest cm3. (Take p = 22/7).

OBSERVATION

The chief examiner reported that majority of the candidates attempted this question and many performed well. However, some candidates could not interpret the relationship between a cone and an arc of a circle correctly. While some candidates used the slant height of the cone as the height of the cone, others used the radius of the arc as the radius of the base of the cone. A few other candidates were not able to draw the diagram correctly.

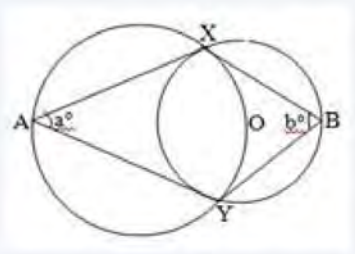
This diagram would have aided them to establish that the length of the arc of the circle = circumference of the base of the cone and that the radius of the sector = slant height of the cone. i.e. 135/360 x 2 x p x 40/1 = 2 x p x r where r = base radius of cone. Simplifying gave r = 15cm.

Slant height of cone, = l = 40cm, r = 15cm. Using pythagoras theorem,
h2 + r2 = l 2 where h = perpendicular height of cone.
\ h = √402 - 152 = 37.081 cm. Therefore volume of Cone = 1/3 x p x r2 x h

$\frac{1}{3} \times \frac{22}{7} \times 15 \times 15 \times 37.081 = \frac{1}{1}$ 8741cm3 to the nearest cm3.

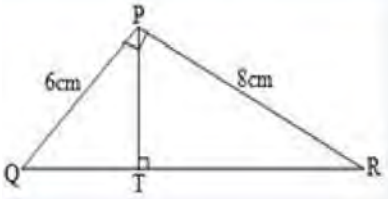
QUESTION 5

(a)



In the diagram, the two circles intersect at X and Y. The centre of the smaller circle is on the circumference of the bigger circle. A and B are any two points on the major arcs, one on each circle. Find an equation connecting a and b.

(b)



In the diagram <QPR = <PTR = 90°, /PR/ = 8cm and /QP/ = 6cm. Find /TR/.

OBSERVATION

The report stated that majority of the candidates could not answer part (a) of this question correctly which showed a poor knowledge of circle theorems. They were expected to join X and Y to O. This made <XOY and <XAY opposite angles of a cyclic quadrilateral and are supplementary i.e. a° + <XOY = 180°. Also, <XOY = 2b° i.e. angle at the centre of a circle is twice angle at the circumference. This implied that 2b° = 180 - a° or a° + 2b° = 180°.

It was reported that candidates performed better in part (b) than in part (a). A good number of them were able to find the tangent of the angle at R and hence the angle at R as 36.87°. Thus, they were able to obtain /TR/ = 8 cos R i.e. 8 cos 36.87° = 6.4cm.

QUESTION 6

(a) By how much is 110002 greater than or les than 1112 x 112?

(b) A shopkeeper has in stock 20 televisions set percent. He sells 18 of them at a profit of 15 percent and the remaining two at a loss of 5 percentage. Find his profit on the 20 sets.

OBSERVATION

The report also stated that although majority of the candidates attempted part (a) of the question and performed well in it, it was observed that majority of them converted first to base ten, solved it and converted back to base 2. Very few candidates were reported to have worked in base 2. 1112 = 112 = 101012.

110002 - 101012 = 112.

In part (b), majority of the candidates were reported to have found the question quite challenging. They were expected to show that if p is the cost price of a television set, then the total sales for 18 sets = $\frac{115}{}$ x 18p = 20.7p. Similarly, total 100 sales for 2 sets = 95/100 x 2p = 1.9p. Therefore total sales on the 20 sets x 20.7p + 1.9p = 22.6p. Total cost price on the 20 sets = 20p. Hence, percentage profit

$$= \frac{22.6p - 20p}{20p} \times \frac{100}{1} = 13\%.$$

QUESTION 7

The marks scored by 50 students in a Geography examination are as follows:

60	54	40	67	53	73	37	55	62	43
44	69	39	32	45	58	48	67	39	51
46	59	40	52	61	48	23	60	59	47
65	58	74	47	40	59	68	51	50	50
71	51	26	36	38	70	46	40	51	42

1. Using a class interval of 21-30, 31-40, …, prepare a frequency distribution table.
2. Draw a histogram to represent the distribution.
3. Use your histogram to estimate the modal mark.
4. If a student is selected at random, find the probability that he/she obtains a mark greater than 63.

OBSERVATION

This was also another question which was reportedly attempted by majority of the candidates and their performance was described as fair. It was also reported that many candidates drew bar charts instead of histograms while others did not use class boundaries in drawing the graph but they rather used class limits. Interpretation of the graph was also an observed challenge.

The grouped frequency table is given by

Class Interval	f	Cf	Class Boundary
21-30	2	2	20.5 - 30.5
31-40	10	12	30.5 - 40.5
41-50	12	24	40.5 - 50.5
51-60	15	39	50.5 - 60.5
61-70	8	47	60.5 - 70.5
71-80	3	50	70.5 - 80.5

The graph is given below

QUESTION 8

The area of a rectangular football field is 7200m2 while its perimeter is 360m. calculate the:

1. dimensions of the field;
2. cost of clearing the field at N6.50 per square meter, leaving a margin of 2m wide along the longer sides;
3. percentage of the part not cleared.

OBSERVATION

It was reported that majority of the candidates who attempted this question were able to derive the two equations i.e. if x = length of field and y = breadth, then

xy = 7200; x + y = 180. They were able to solve these equations and also obtained the dimensions as 60m and 120m. However, attempt on the parts (b) and (c) was poorly handed by some of the candidates. Many took the margin to be all round the field but the question specified along the longer sides. Thus cost of clearing the field = N6.50 x 56 x 120 = N43,680.00. The percentage of the part not cleared

$$= \frac{7200 - (120 \times 56)}{7200} \times 100 = 62/3 \text{ or } 6.67\%$$

Candidates, who sketched the diagram, were reported to have performed well in the question.

QUESTION 9

In the diagram, a ladder LN 10m long, rests on a wall 4.5m high such that 2.5m of it projects beyond the wall.

1. Calculate, correct to one decimal place, the angle which the ladder makes with the ground.
2. How high above the ground is the upper end of the ladder?

If the foot of the ladder is moved by 2m further away from the wall, calculate, correct to the nearest degree, the angle which the ladder makes with the ground

OBSERVATION

Candidates' attempt on this question was fair especially parts (a) and (b). Many of them missed the (c) part because they did not quite understand what would happen as the ladder was moved by 2m further away from the wall. If the foot of ladder is moved a further 2m away from th

QUESTION 10

In a class of 200 students, 70 offered Physics, 90 Chemistry, 100 Mathematics while 24 did not offer any of the three subjects. Twenty three (23) students offered Physics and Chemistry, 41 Chemistry and Mathematics while 8 offered all three subjects.

Draw a Venn diagram to illustrate the information.

Find the probability that a student selected at random from the class offered:
- Physics only;
- Exactly two of the subjects.

OBSERVATION

This question was popular and the candidates did well in it. Though many were able to draw the correct Venn diagram, they could not determine the correct number of students who offered physics and those who offered exactly two of the subjects. Hence, they could not find the required probabilities. They were expected to denote the number of those who offered Physics and Chemistry only by a variable say x, equate the entries to 200 to get 100 + x + 49 - x + 47 - x + 24 = 200, from where x = 20. Number who offered Physics only = 47 - 20 = 27. Therefore probability of those who offered Physics only = 27/200.

Number of those who offered exactly 2 subjects = 15 + 20 + 33 = 68. Probability of those who offered exactly 2 subjects = 68/200 = 17/50

QUESTION 11

Using ruler and a pair of compasses only, construct a quadrilateral PQRS in which /QR/ = 6cm, <PQR = 90o, <QRS = 120˚, /RS/ = 8cm and /PQ/ = /PS/. Measure /PQ/.

OBSERVATION

This question was unpopular as usual. The few candidates who attempted it were able to construct angles 90˚ and 120˚ as required of them. However, they were unable to locate the point P and this cost them some marks. Some others drew the angles instead of constructing them

QUESTION 12

In the diagram, /PR/ = /RQ/, /RS/ = 10cm <RPS = 70o and <PQR = 30°. Calculate /PS/.

(b) Two points A and B lie on the parallel of latitude 60oN. A lies on longitude 20oE and B is 1500km due east of A. Calculate the:

radius of the parallel of latitude on which they lie;
longitude on which point B lies correct to the nearest degree. (Take π = 3.142, radius of the earth = 6400km)

OBSERVATION

The part (a) of the question was well interpreted by most of the candidates who attempted the question. They were able to get <PRS = 60° and apply the sine rule correctly.

In part (b), most candidates got the radius of the latitude but could not go further to find the longitude of B by adding 20° to the θ calculated.

QUESTION 13

(a) The first term of an Arithmetic Progression (A.P.) is 31 and the common difference is 9. Show that the nth term is 9n + 22. Hence, find the 20th term.

- common ratio;
- first term;
- eighth term.

OBSERVATION

Many candidates were able to show that the nth term is 9n + 22 but they did not use this formula to calculate the 20th term. Rather, they used the general formula which was not required of them. They were expected to substitute 20 for n in the expression to get 9(20) + 22 = 202.

Candidates also performed well in the (b) part of the question. They were able to derive the equations ar = 1 and ar4 =1/8 .
However, some of them were not able to solve for a and r correctly because of the fraction involved and this also affected their getting the eighth term correctly.

Questions 14 and 15 were not meant for candidates in Nigeria and no responses were required.